

NASA Ames Research Center, Computational
Sciences Division

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Sciences Division

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National Aeronautics and Space Administration
Ames Research Center
Computational Sciences Division

David A. Maluf, Ph.D.

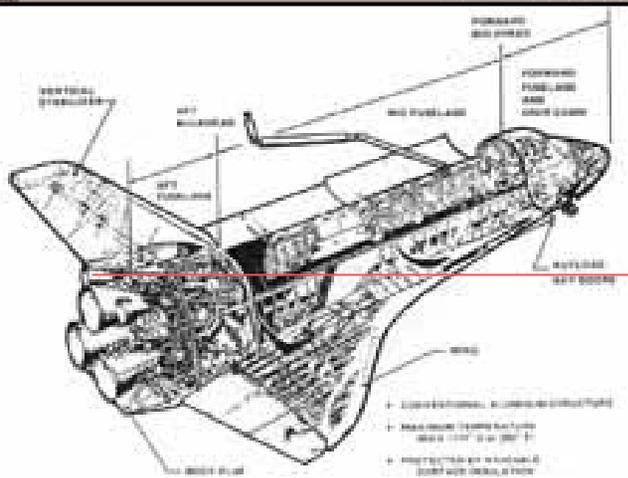
Kevin Bass QSS
David Bell Ph.D. RIACS
Julian Gomez Ph.D. RIACS
Mohana Gurali RIACS
Tracy La CSC
Jenessa Lin NASA
William McDermott NASA
Jimmy McClenahan QSS
Peter Tran QSS

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Purpose: to control and interoperate with every block in a document, email, spreadsheet, power point, database, etc. across the lifecycle.

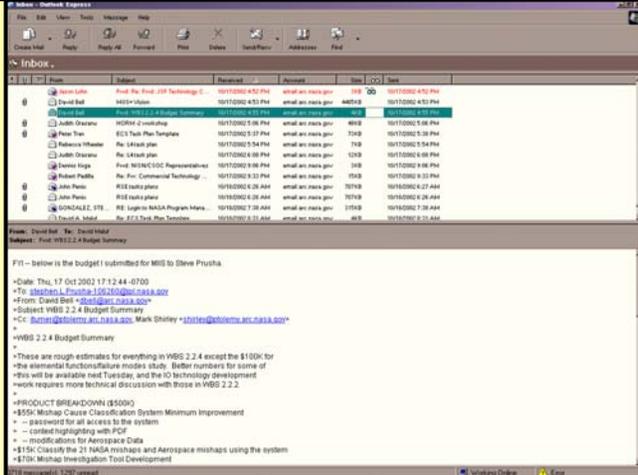
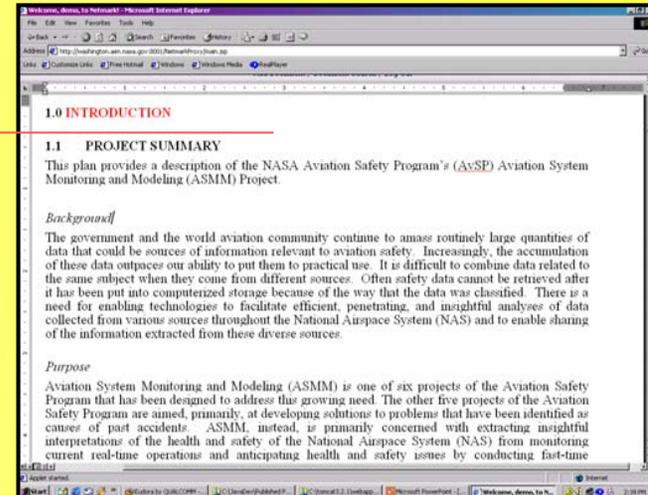
As of Oct 15, 2002					
1.0 Engineering for Complex System					
2.0 System Reasoning Risk Management					
2.1 Risk Tools Development & Deployment	JPL	Steve Frusha	stephen.frusha@nasa.gov	916-354-5323	
2.1.1 Risk Workstation	JPL	Steve Frusha	stephen.frusha@nasa.gov	916-354-5323	
2.1.2 System Complexity Research	ARC	Steven Cornford	scornfor@nasa.gov	916-354-7671	
2.1.3 Risk-Based Design and Optimization	ARC	Jagan Turner	jturner@mail.arc.nasa.gov	950-604-4840	
2.2 Core Risk Research	JPL	Ivan Neva	ivan.neva@nasa.gov	916-354-2595	
2.2.1 Model Based Hazard-Risk Analysis	ARC	Ivan Turner	turner@mail.arc.nasa.gov	950-604-4038	
2.2.2 Risk Investigation Research	ARC	Mark Shirley	mshirley@mail.arc.nasa.gov	950-604-3389	
2.2.3 Risk Characterization and Visualization (RCMV)	JPL	Tina Pennington	tpenning@mail.arc.nasa.gov	950-604-6197	
2.2.4 MIS: Mishap Indicator Identification System	ARC	Mark S. Fisher	mark.s.fisher@nasa.gov	916-354-1194	
	ARC	Dave Bell	dbell@mail.arc.nasa.gov	950-604-0771	
3.0 Knowledge Engineering for Safe Systems	ARC	Patricia Jones	patjones@mail.arc.nasa.gov	950-604-1345	
3.1 Human & Org Risk Management	ARC	Judith Orasanu	orasanu@mail.arc.nasa.gov	950-604-3404	
3.1.1 Organizational Risk Perception & Mgmt.	ARC	Judith Orasanu	orasanu@mail.arc.nasa.gov	950-604-3404	
3.1.2 Operations Information Analysis	JSC	Steven Gonzalez	stgona@nasa.gov	218-483-5471	
3.1.3 Human & Organizational Risk Aspects of Distributed Collaborative Design	JPL	Frederica Wheeler	fwheeler@mail.arc.nasa.gov	916-354-1243	
3.2 Engineering Information Management	ARC	Dwain A. Maluf	maluf@mail.arc.nasa.gov	950-604-0811	
3.2.1 Lifecycle Systems Integration	ARC	Paul Kattler	pkattler@mail.arc.nasa.gov	950-604-6134	
3.2.2 Virtual son Net	ARC	Paul Kattler	pkattler@mail.arc.nasa.gov	950-604-6134	
3.2.3 Digital Modeling	KSC	Michael Conroy	mconroy@mail.arc.nasa.gov	950-607-2490	
3.2.4 View Integrity Research	ARC	Larry Cookson	lcookson@mail.arc.nasa.gov	950-604-2551	
4.0 Resilient Systems & Operations	ARC	Joan Pallas	jpallas@mail.arc.nasa.gov	950-604-0332	
4.1 Intelligent & Adaptive Ops & Control	ARC	Joan Pallas	jpallas@mail.arc.nasa.gov	950-604-0332	
4.1.1 Applied Autonomous Aerospace Vehicle Technologies	ARC	Oregon A. Doran	odoran@arc.nasa.gov	950-604-4951	
4.1.2 Autonomous Propulsion System Technology	GRC	Sansar Garg	sgarg@arc.nasa.gov	218-433-2689	
4.1.3 Adaptive Flight Control Research	DFRC	Larry Henry	larry.henry@nasa.gov	661-276-3159	
4.1.4 Human Machine Interactions	ARC	Robert A. McQueen	rmcqueen@mail.arc.nasa.gov	950-604-0662	
4.2 Resilient Software Engineering	ARC	John Penik	penik@arc.nasa.gov	950-604-6576	
4.2.1 High Dependability Computing	ARC	Michael Lowry	mlowry@mail.arc.nasa.gov	950-604-3369	



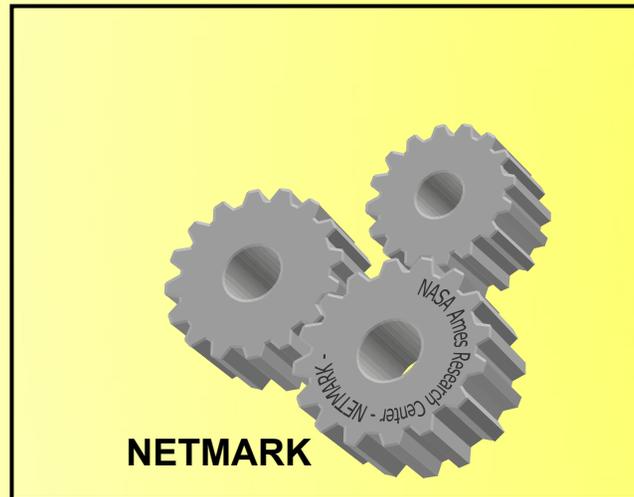
Spread sheet cell

Word document paragraph, title etc.

Media and data
Electronic mail paragraph, subjects, headings, etc.



The Mechanics



Load seamlessly into Netmark

Context plus Content search

Regenerate arbitrary
documents from arbitrary
fragments

to some extent ...garbage in, garbage
out.

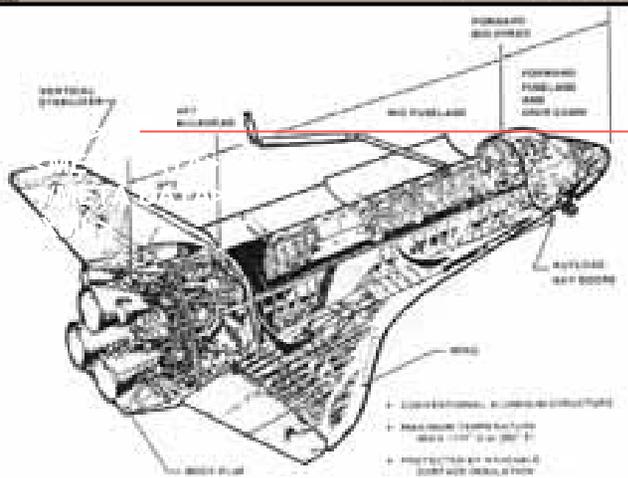
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As of Oct 15, 2002

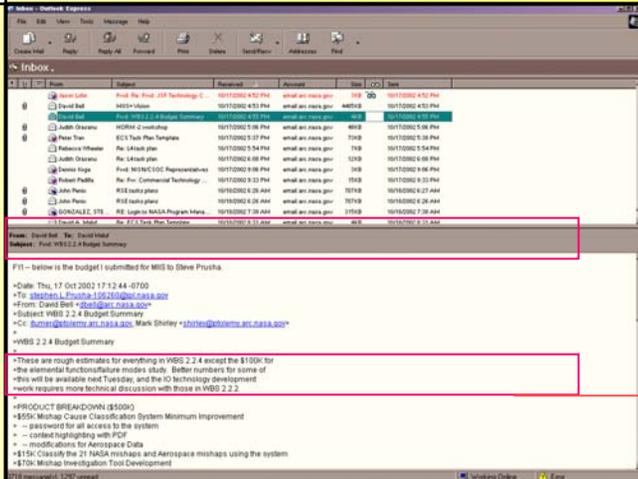
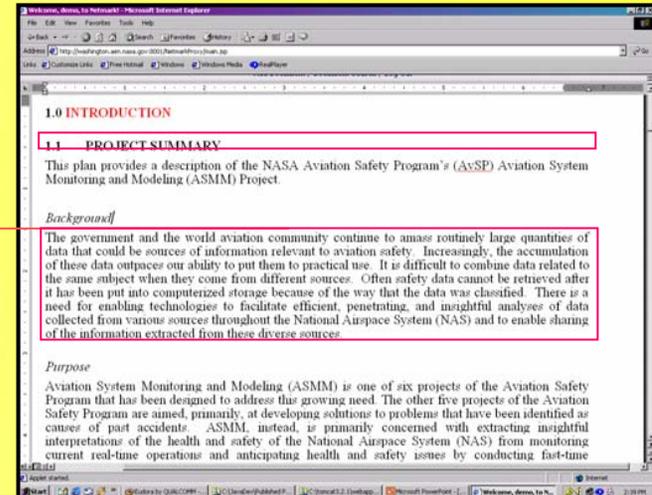
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4.1 Intelligent & Adaptive Ops & Control	ARC	Joan Palle	jpalle@mail.arc.nasa.gov
4.1.1 Applied Autonomous Aerospace Vehicle Technologies	ARC	Oregan A. Dorais	odorais@mail.arc.nasa.gov
4.1.2 Autonomous Propulsion System Technology	ARC	Sansar Garg	sgarg@mail.arc.nasa.gov
4.1.3 Adaptive Flight Control Research	DFRC	Larry Henry	lharry@mail.arc.nasa.gov
4.1.4 Human Machine Interfaces	ARC	Robert S. McCann	rmccann@mail.arc.nasa.gov
4.2 Resilient Software Engineering	ARC	John Penik	penik@mail.arc.nasa.gov
4.2.1 High Dependability Computing	ARC	Michael Lowry	mlowry@mail.arc.nasa.gov

A fragment in a Spreadsheet is a cell, row, column etc.



Fragments in media data depend on the definitions set within meta data.

Fragments in a word document are headings, paragraphs etc.



A fragment in emails is a heading, paragraph etc.

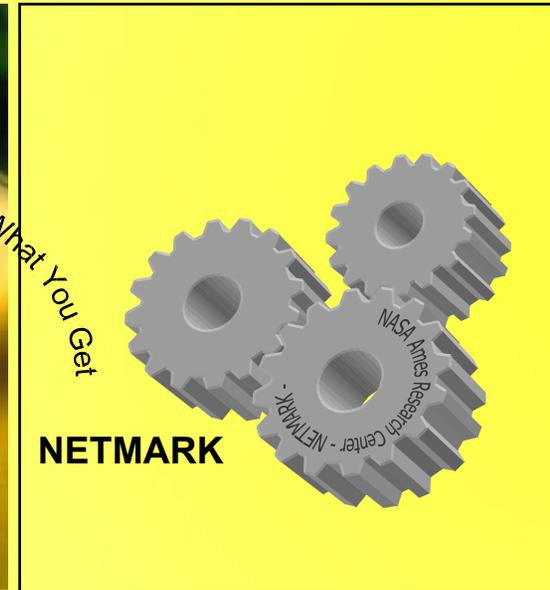
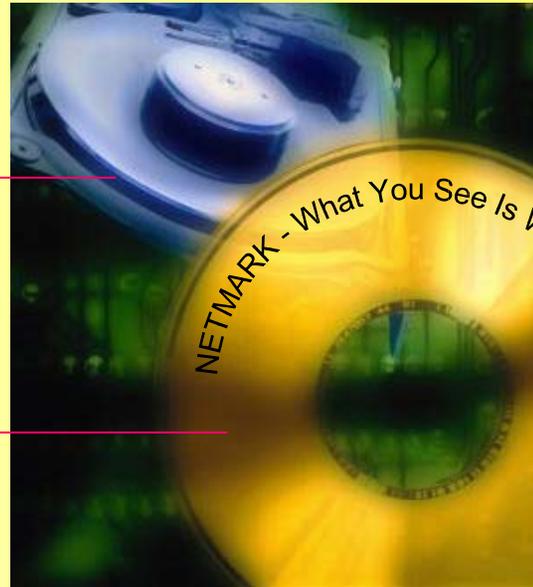
Netmark is a middleware enabling an Enterprise
the **What You See Is What You Get –**
WYSIWYG - for information management.

The Mechanics

Netmark adds a layer in the information
systems paradigm between the documents
and storage. Netmark “**pages**” the
information fragment the way created by
the user-end.

Netmark maintains the relationships
among the fragments of your data the way
created by the user-end.

Netmark provide a fast mechanism to
search on context plus content or
relationship concepts among the
fragments.



Indexed **context**
Indexed content
Fragments linked as in original source

Dynamic Schema-less Definitions

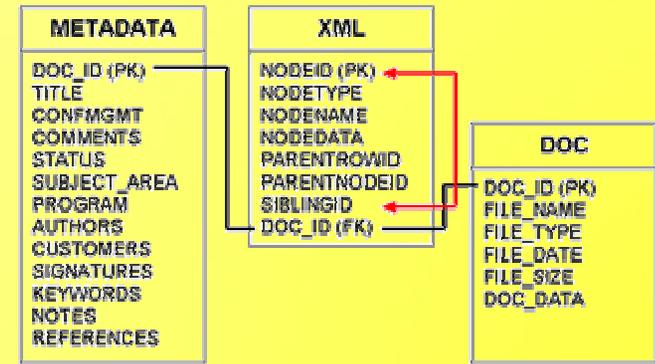


Figure 3: NETMARK Generated Schema

Extensible Architectures

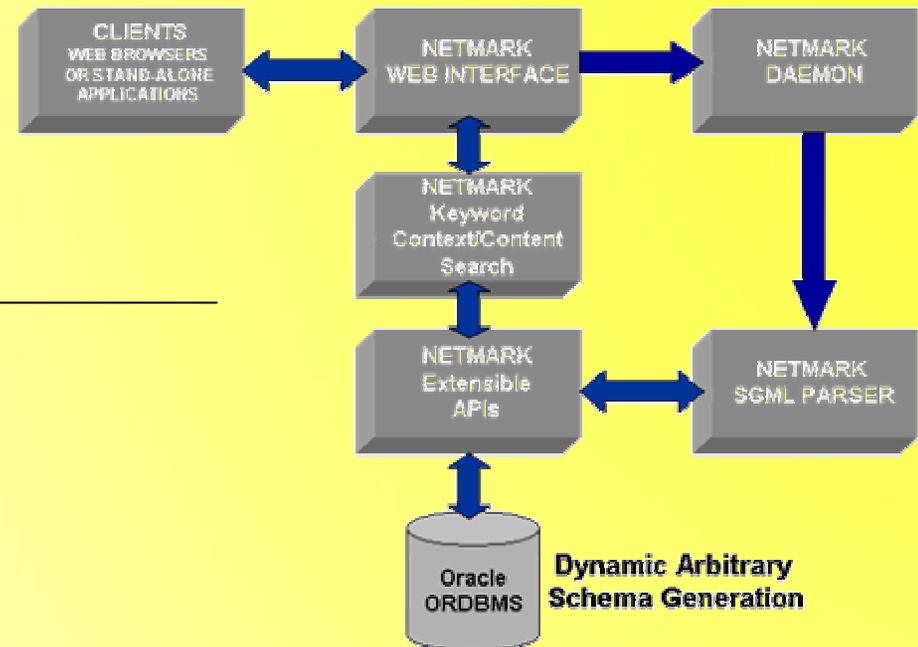


Figure 2: NETMARK Universal Process Flow

Seamless information System

Sources identified:

Non-normalized data: MS
Word documents,
Excel, Adobe PDF, XML,
HTML, Binary, meta-data.
Normalized data: relational
and object oriented.

Interlingua

SGML: XML, HTML

Translation:

Microsoft Office,
Adobe, Transliteration,
WordNet (semantic relations)

Mass Storage:

Oracle



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Requirements

OPERATING SYSTEM

Sun Solaris™ 2.6, 2.7 & 2.8

Red Hat Linux 7.0 (*)

JDK SUPPORT

Java 2 (JDK 1.2, 1.3)

C/C++

SYNCHRONIZATION WITH RDBMS

Oracle

Extensible API

C/C++

Java

PL/SQL

Out of the Box

WebDav,
NFS, FTP, HTTP



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Engineering for Complex Systems
Mishap Report Analysis



Mars Polar Lander accident



X31 accident

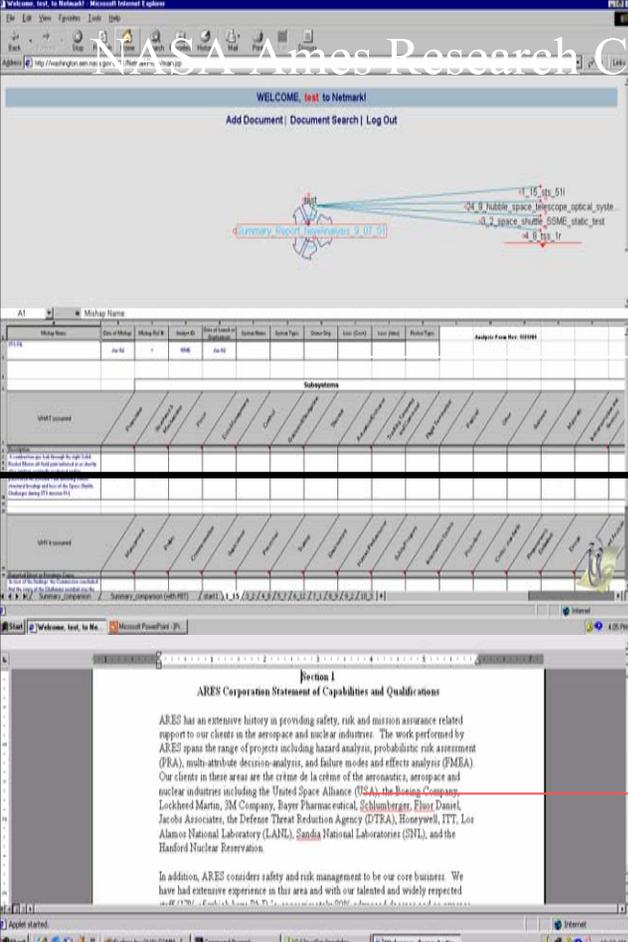


DC-XA accident



Challenger accident





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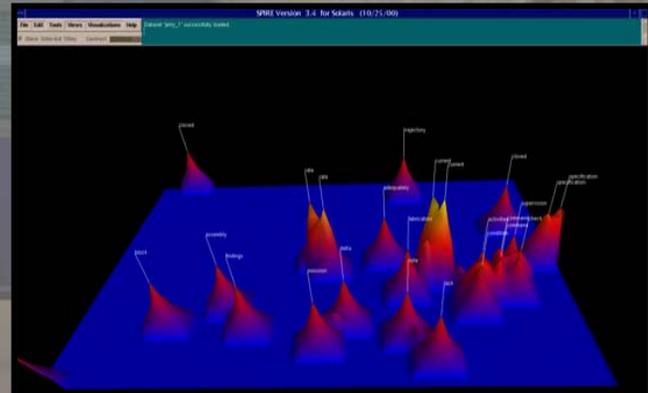
Software development Zero
Setup time/Integration 1FTE, 2 Days

23 Mishap Report Analyzed

Analysis of range of incidents involving NASA & non-NASA aircraft/spacecraft

Selected Sections from the Mishap Reports were loaded into the data analysis tool

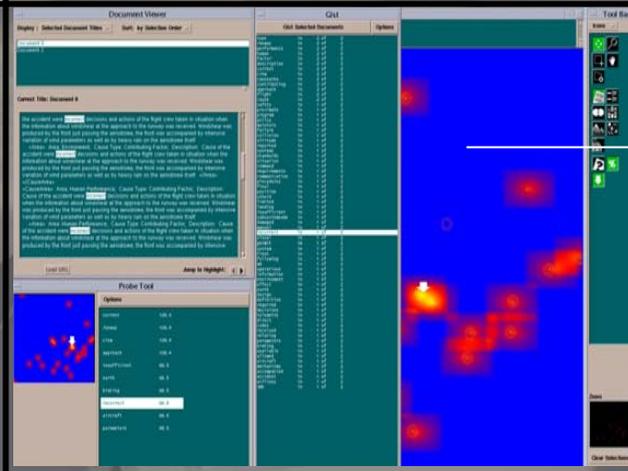
Drill-down into Documents



Reports distributed across a two-dimensional space based on similarities between reports

Content-based visualization derived from Galaxies visualization

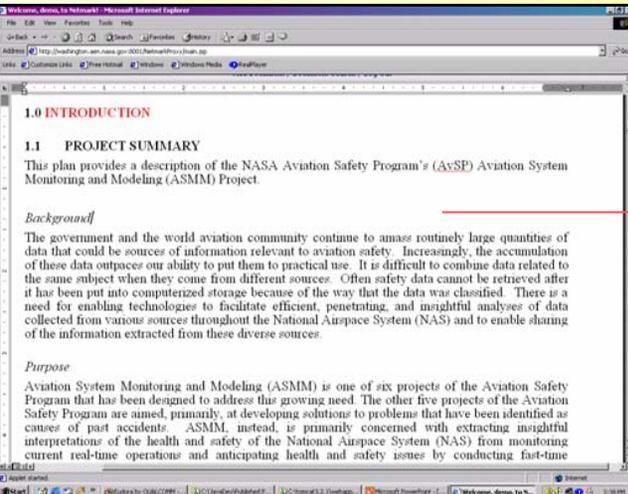
3D visualization in abstract landscape that represents areas of high thematic content



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Software development Zero
Setup time/Integration 0 FTE, 0 Days

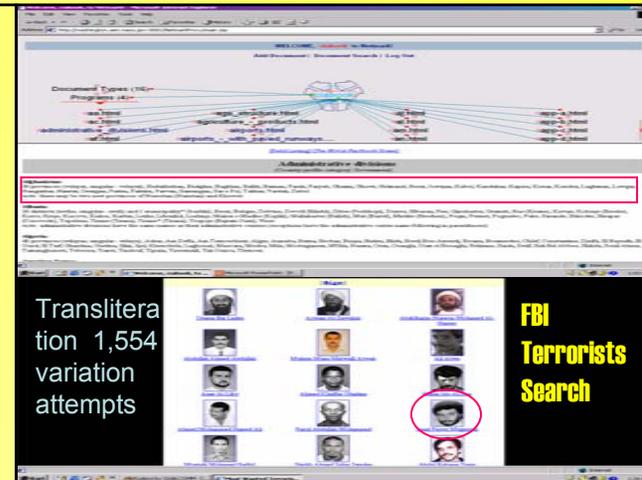


Re-editing: Document construct from disparate documents and fragments, paragraph, Tables, etc.

Search: Meta-Data Directory
Identifying multiple data sources –
5 federal agencies

Integrated Response
highlighting information features

Actual relevant record(s)
Highlighting matches



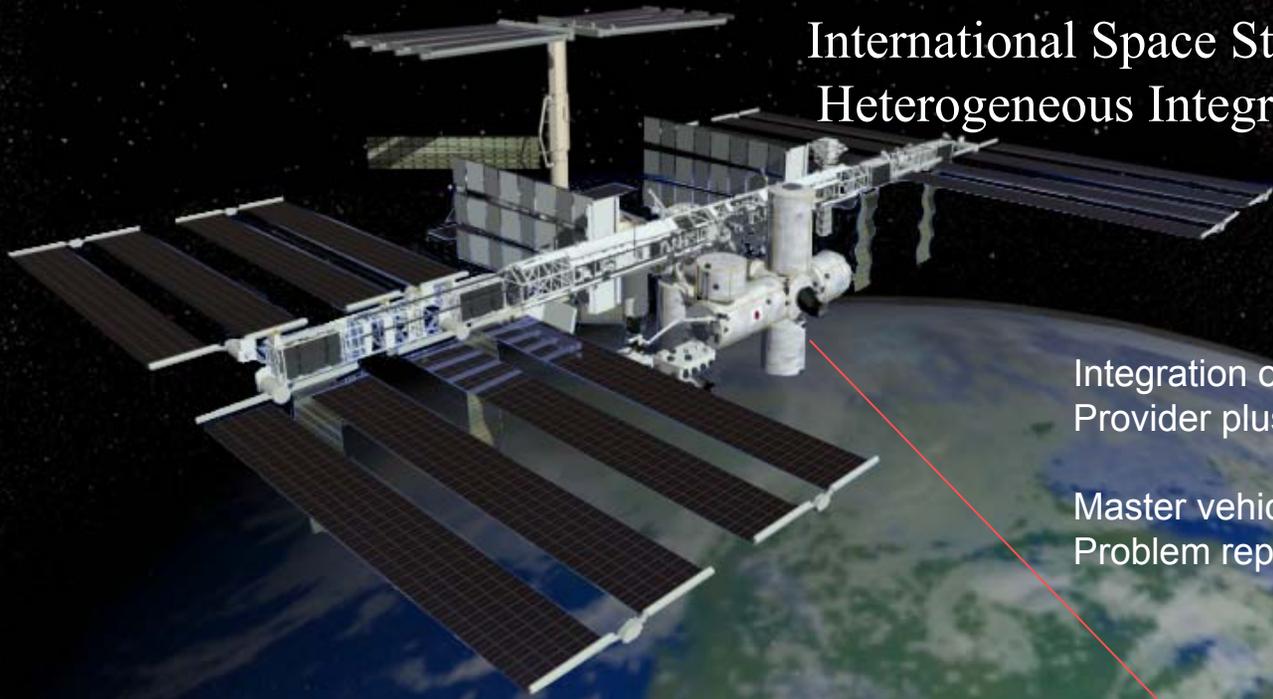
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International Space Station
Heterogeneous Integration

Integration of databases, heterogeneous in
Provider plus content

Master vehicle database
Problem reporting corrective action database



Mars
Altitude: 7,200,000 km
Radius: 3394.000 km
Day length: 24.623 hours
Temperature: 211 K

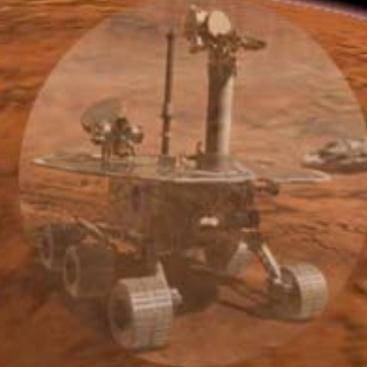
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2002 10 25 19:44:12 UTC
Real time

Mars Exploration Rover - MER
MER CIP HCC

Meta data capture of Mars 03 mission



Speed: 0.000 m/s

Sync Orbit Mars
FOV: 18 10' 52.0"

Real time integration

```
<XML>
  <source> Master database
    <access_method> RDBMS
  ...
  <source> PRACA
    <access_method> http://ww...

  <preprocess_using>
    <query_template> ..

  <postprocess_using>
    <Transliteration> ...
```

Client query provided from the (sever)

```
<query_template>
  <form action ..>
    <input ..>
  </form>
```

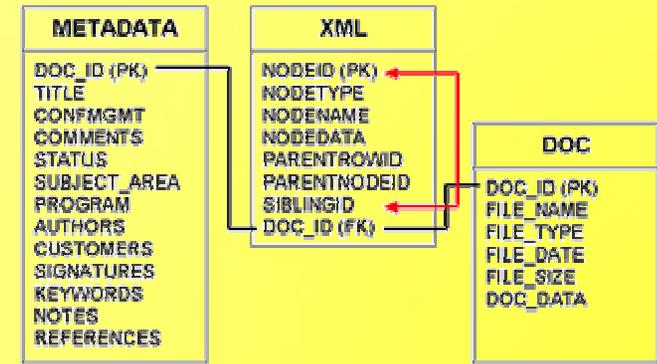


Figure 3: NETMARK Generated Schema

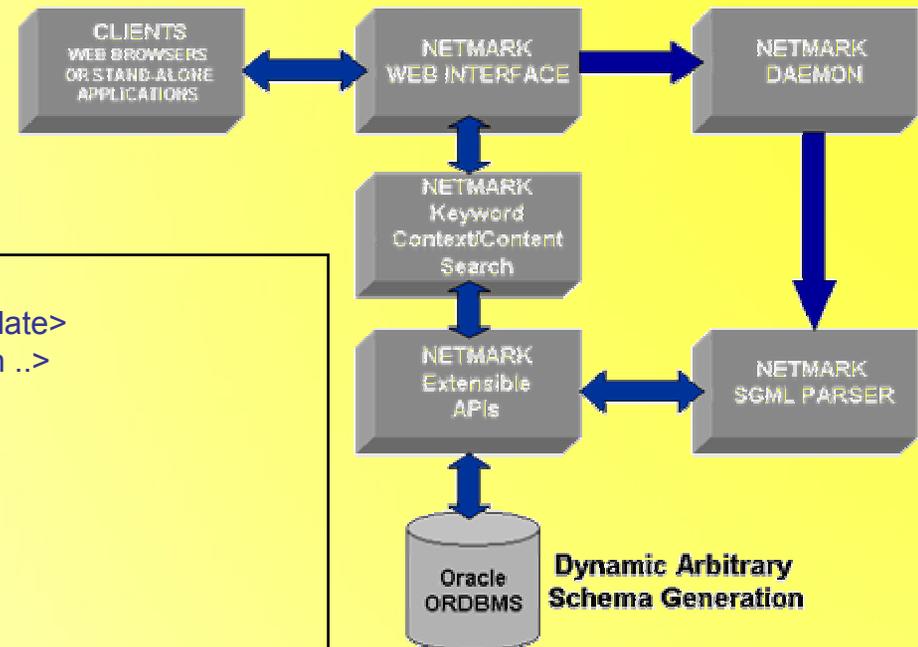
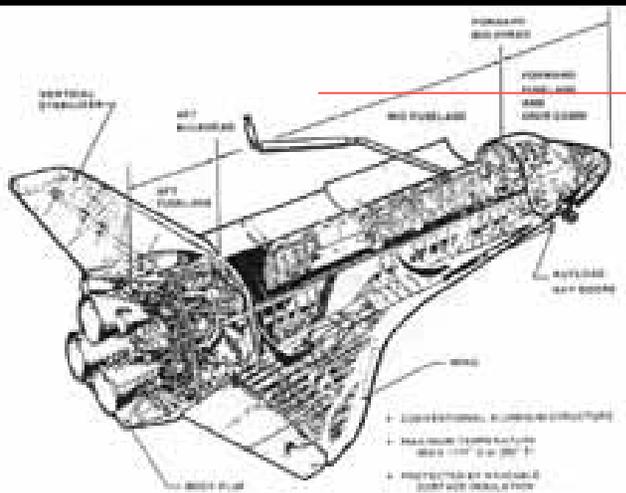


Figure 2: NETMARK Universal Process Flow

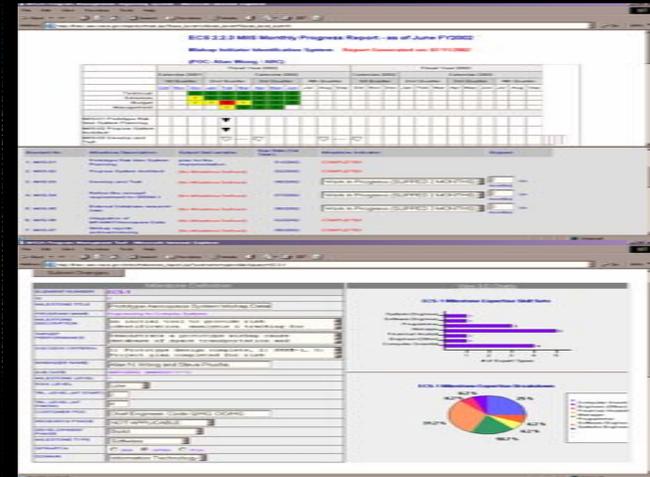
Engineering for Complex Systems



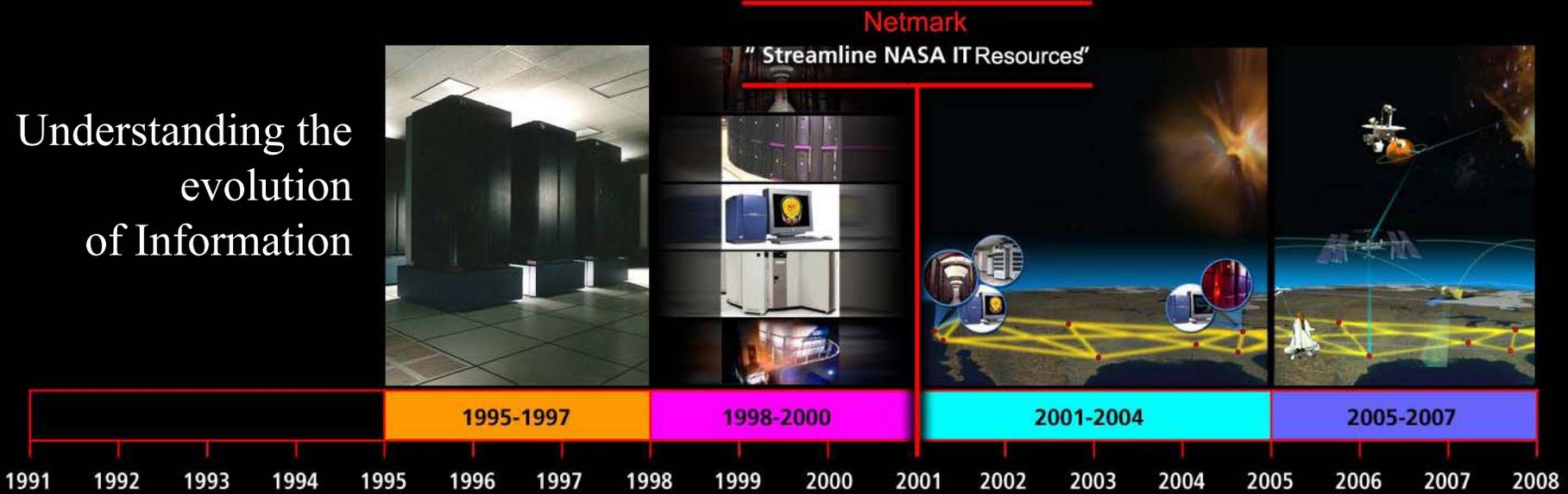
Kennedy space center Digital Shuttle Project knowledge management system for a virtual space shuttle orbiter, including legacy data, engineering data, and 3D graphics models.

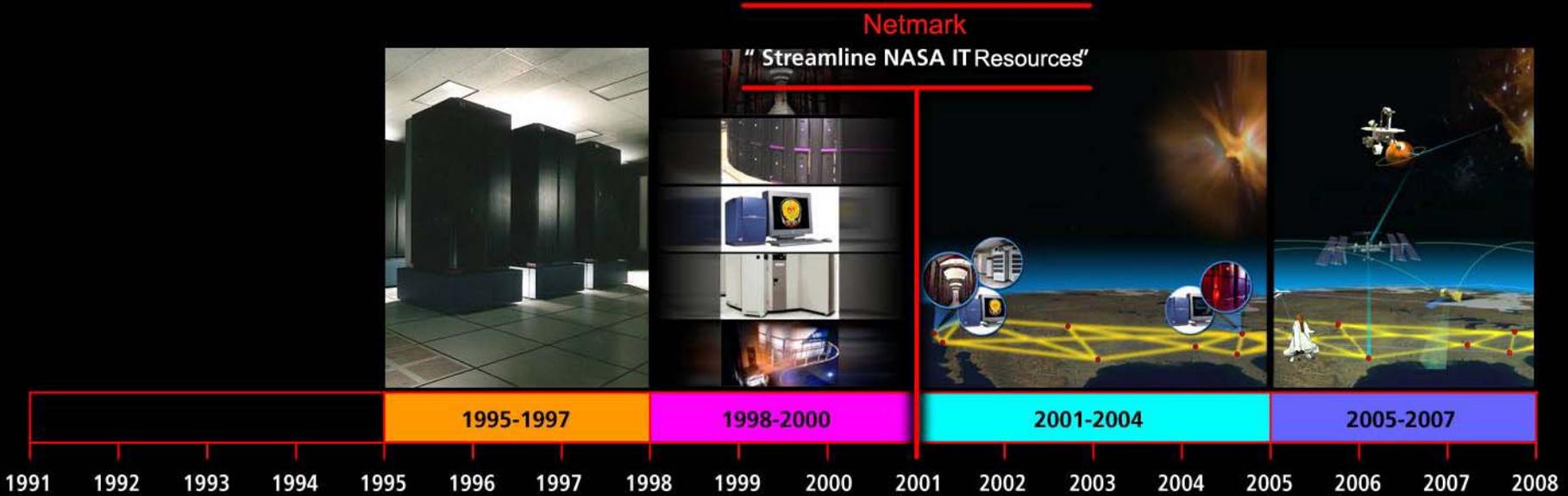
Engineering for Complex Systems Program management tool, a WYSIWG approach (designed as build)

- Zero database intervention



Understanding the evolution of Information





High Throughput

Faster & Better
Cheaper

Problem space

Problem space is exponential
Solution space has been linear

Solution space

Current Solution Space

NASA investment



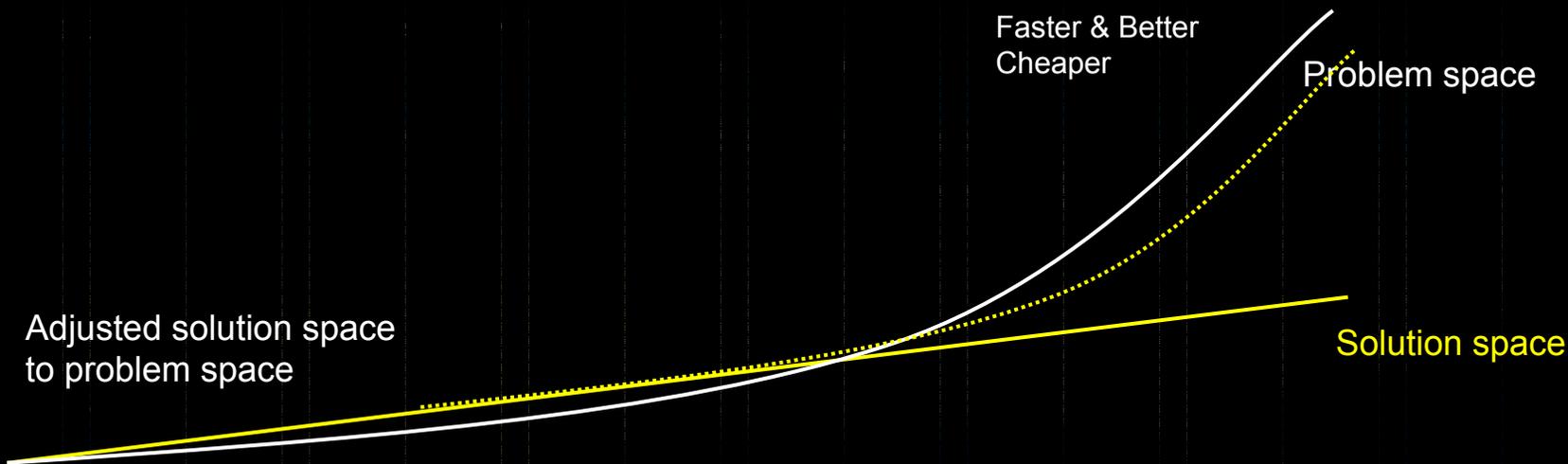
High Throughput

Faster & Better
Cheaper

Problem space

Adjusted solution space
to problem space

Solution space

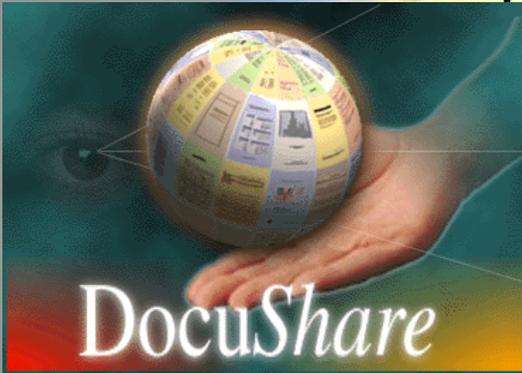


What is it to outside NASA

- "Partial Spillovers" for the economics and conditions where third parties derive benefits which they do not pay initially for.
- "Market spillovers" is likely to be an efficiency gain to the new end-users of these technologies.
- "Knowledge spillovers" will happen when firms get cheap access to lessons learned in both technology and successful models.
- "Network spillovers" the synergy, and also having an open source architecture on common problems and expand on related pieces in a coordinated way and according to a condensed time schedule.

What You See Is What You Get

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The future ... 2008